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ABSTRACT

The field of search and rescue has long been dominated by the helicopter. Vertical takeoff and landing (VTOL) aircraft are the next step in search and rescue technology. They can hover and maneuver at low airspeeds, but can cruise at much faster speeds and lift larger loads than traditional helicopters. The Advanced Virginia Amphibious Tilt Rotor (AVATR) Soterion is a versatile, innovative rotorcraft designed to push the boundaries of rotorcraft cruise speed, range, and passenger capacity. Innovative design features allow the Soterion to meet key performance metrics such as an 863 nm range at a 300 knot cruise speed while carrying 50 passengers. The Soterion's center-mounted engines are shafted to wing-tip nacelles housing variable diameter rotors (VDRs) that decrease in diameter during hover-to-cruise transition. The strategic engine location minimizes salt water ingestion during water landings and keeps engine exhaust directed away from water and passengers. In this configuration, unlike the V-22, the engines are fixed and only the rotor nacelles rotate. State-of-the-art VDRs combined with continuously variable transmissions provide a solution for the conflicting requirements of vertical and forward flight. Additionally, the rotor nacelles house deployable floats to increase the aircraft's stability in the water. These floats retract into the nacelles to increase aerodynamic performance in cruise mode.

The multifunctional nature of the Soterion will greatly enhance disaster relief response. Earthquakes, hurricanes, and other catastrophes often destroy ground and air transportation infrastructure, making VTOL aircraft an essential part of emergency relief. The Soterion can take off vertically in short spaces, giving it the ability to pick up people from rooftops and uneven terrain for which a conventional landing is impossible. Its large passenger capacity makes it a valuable tool for sea rescues and disaster zones because it has enough cargo space to include medical and transport equipment. Its increased range (863 nm) and high cruise speed (300 kts) make it ideal for long range rescues. The Soterion also features a cargo area designed to rapidly adapt to multi-mission specifications ranging from large rescue operations to firefighting. In addition to the modular water tanks that can be inserted for firefighting missions, the Soterion houses a scooping mechanism for the intake, mixing, and dispersal of fire retardant.

The conceptual design presented in this report meets and exceeds the requirements for a versatile amphibious tiltrotor capable of responding to natural and man-made disasters. The AVATR Soterion is a pioneering solution to civilian search-and-rescue demands.